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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 1, SESSION 2017/2018

**EEL4116 – POWER STATIONS**  
(LE)

13 OCTOBER 2017  
9:00 AM – 11:00 AM  
(2 Hours)

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### INSTRUCTION TO STUDENT

1. This Question Paper consists of 3 pages with 5 Questions only.
2. Answer **ALL** questions. All questions carry equal marks and the distribution of marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

**Question 1**

(a) Explain what do the load curves represent, and how the load curves of a generating station are plotted. Draw a typical load curve and load duration curve. Explain base load, intermediate load and peak load. [8 marks]

(b) There are 10 residential consumers connected to the main circuit breaker. The demand factor and the connected load of each consumer are given in the table below. The diversity factor of the group of 10 residential consumers is 1.2. Calculate the maximum demand on the transformer. [12 marks]

Consumer	1	2	3	4	5	6	7	8	9	10
Demand Factor	0.60	0.55	0.65	0.55	0.62	0.70	0.50	0.60	0.64	0.70
Connected load	10	15	20	8	12	15	9	5	11	7

**Question 2**

(a) Explain, with a neat schematic diagram, the operation of a combined cycle gas turbine power plant. [15 marks]

(b) A coal usage steam power plant has a turbine generator rated at 1200 MW gross. The plant requires 8% of this power for its internal operations. It uses 9800 tons of coal of heating value 26 MJ/kg per day. Calculate the gross and net station efficiencies. [5 marks]

**Question 3**

(a) Explain, with a neat sketch, the working principle of a thermal power plant. [12 marks]

(b) State the advantages and disadvantages of Diesel Power Station. [8 marks]

**Question 4**

(a) Sketch a one-line diagram of a well protected substation transformer and explain the functions of each protection component. [10 marks]

**Continued...**

(b) In Figure Q4b, assume a fault occurs in feeder 3. Discuss the relationship of circuit breakers, reclosers, and sectionalizers in Figure Q4b. [5 marks]

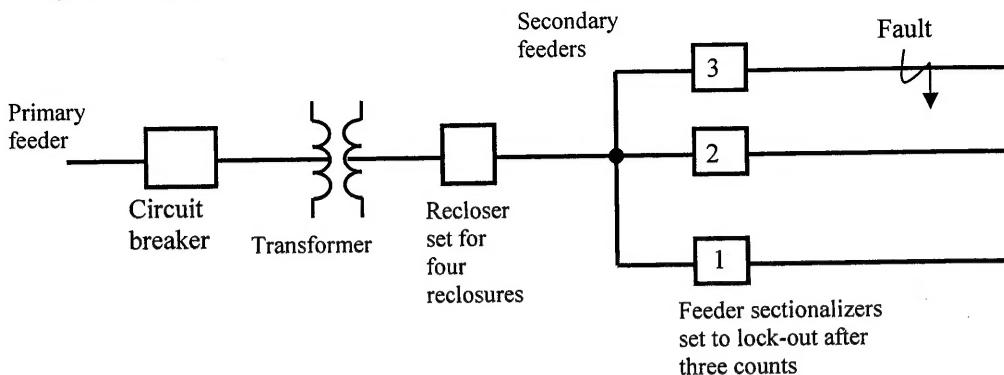


Figure Q4b

(c) In a power plant, the efficiencies of the electric generator, turbine, boiler, cycle and the overall plant are 0.97, 0.95, 0.92, 0.42 and 0.33, respectively. What percentage of the total electricity generated is consumed in running the auxiliaries? [5 marks]

### Question 5

(a) An industry consumes  $4 \times 10^6$  kWh per annum with a maximum demand of 1000 kW at 0.8 pf lagging. [2 marks]

(i) What is its load factor?

(ii) Calculate the annual bill if the tariff rate is as follows:

Maximum demand charge = RM 5.0 per kVA per month

Energy charge = RM 0.35 per kWh

(iii) If a suitable reactive power compensating device is used to improve the power factor of the load to unity and if no change in the maximum power demand, calculate the new annual bill after adding the power compensating device. [5 marks]

(b) A consumer uses 1500 kWh under block rate tariff as follows:

For the first 200 kWh: RM 0.218 per kWh

For the next 800 kWh: RM 0.258 per kWh

For the additional energy consumed: RM 0.278 per kWh

Calculate the total cost of electrical energy and average cost for this consumer.

[5 marks]

(c) The capital cost of a power generating equipment in a power plant is RM  $80 \times 106$ . The useful life of the plant is 30 years and its salvage value is 5% of its capital cost. Determine the amount of money to be deposited annually for replacement

(i) by straight line method

(ii) by sinking-fund method. Assume that the annual compound interest is 6%.

[5 marks]

**End of paper.**